



Ocean acidification in long-term future climate simulations

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The Bern2.5CC earth system model of intermediate complexity is used to project long-term ocean acidification from increasing atmospheric CO₂. The focus is on (i) ocean acidification commitments for constant atmospheric composition and (ii) commitments in response to earlier carbon emissions. Simulations are run until year 3000 A.D. and extend substantially further into the future than conceptually similar simulations with global coupled climate - carbon cycle models, yet ocean-sediment interactions have been neglected. Atmospheric CO₂ and radiative forcing are prescribed over the historic period up to year 2000 and projected thereafter from CO₂ stabilization profiles. To study post-2100 commitments, carbon emissions were set to zero after year 2100 until the end of the simulation. Projected changes in surface pH, carbonate ion concentration and CaCO₃ saturation states over the 21st century compare well with results from previous studies. For stabilization of atmospheric CO₂ at 1000 ppm and year 2100 (year 2500), high latitude surface pH is projected to decrease by up to 0.35 (0.65) compared to the preindustrial state, and high latitude surface waters will become undersaturated in both calcite and aragonite after 2100. By year 3000 A.D., ocean acidification commitments in response to stabilized atmospheric CO₂ and radiative forcing or in response to earlier carbon emissions are small at the ocean surface, but the acidification signal continues to penetrate the ocean interior, substantially reducing further the volume of saturated ocean waters over time.